Review of: 'Combining Electromagnetic Induction and Remote Sensing Data for Improved Determination of Management Zones for Sustainable Crop Production'

This paper proposes a proximal and remote sensing data harmonisation framework for input into a Self-organizing map (SOM)-based classification for determining field management zones. It is worthy of publication once the following points are considered and addressed:

1. Materials/Methods: The four sub-sections of section 2.2 need re-ordering to demonstrate the workflow: (1) EMI/EC data, (2) RS/NDVI data, (3) Yield data, (4) Soils data. As only the first two are inputs for the SOM/MCASD clustering. The second two are used to 'validate' and refine the clusters.
2. Materials/Methods: A table would be useful to summarise each of these four datasets and their use in the study. The table can list: (a) the period of collection (e.g., 2011-19 for yield data); (b) whether the patchCROP experiment was in operation or not, (c) data processing steps taken (e.g. kriging or some other interpolation, normalisation etc. – see also that stated in section 3), and (d) whether used for SOM/MCASD inputs or used for the (ANOVA-based) validation of SOM clusters (with subsequent merging of clusters) etc.
3. Results: Maps and workflow narratives should be in this order: (1) EMI/EC data (Figs. 3, 4), (2) RS/NDVI data (Fig. 5), (3) Yield data (Fig. 2), (4) Soils data graphic (new), (5) SOM/MCASD clustering maps of EMI/RS plus refinements via yield/soils (Fig. 6).
4. Limitations: When describing the caveats to the methodology (section 3.5), refer to the new Table suggested in (2) for challenges due to different data collection timeframes, patchCROP, data processing, etc.
5. Limitations: What would be the likely consequences of using free, 10m resolution imagery from sentinel 2 say, to that used with the 3m resolution of Planetscope for the NDVI data?
6. Limitations: More on the sensitivity of the SOM-based clusters and their refinements using yield and soil information – from no data available to that available here (as shown in rows 3 and 4 in Fig.6).
7. Limitations: For the clustering methods described (in the introduction) and the SOM method applied (p.6 to p.7) – none implicitly capture spatial effects, such as spatial autocorrelation. Further, the statistical analyses using ANOVAs/Tukey's HSD and t-tests are similarly non-spatial. What are the consequences of this? What methods could be applied for future work to investigate this?
8. Limitations: Given all the above - something on the capture of uncertainty in the demarcation of the management zones for current and future work?
9. Conclusion: More should be said on the choice made for the proximal sensing and the choice made for the satellite remote sensing. For the former, EMI/EC essentially does soil physics / structure / water, while for latter, NDVI does crop health. This is OK but what of the alternatives? For example, using indices from radar-based missions (e.g., sentinel 1) rather than imagery-based missions (e.g., sentinel 2). Insights on how the choice of sensors will ultimately affect the SOM/MCASD clustering and resultant management zones would be useful. For example, in some cases, the precision management of soil water may be more of a focus than the precision management soil nutrients – each requiring specific sensing technologies, etc. Essentially expand discussions in the introduction (p.5-6) and conclusions.

10. Consider changing the title to either: ‘Combining Proximal and Satellite Remote Sensing Data for Improved Determination of Management Zones for Sustainable Crop Production’ or ‘Combining Electromagnetic Induction and Satellite Sensed NDVI Data for Improved Determination of Management Zones for Sustainable Crop Production’ – the former is general, while the latter is specific.